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ABSTRACT

This training unit on water supply is part of a 17-unit course package written to aid instructors in the development, teaching, and evaluation of fire fighters in the Wisconsin Fire Service Certification Series. The purpose stated for the 4-hour unit is to assist the firefighter in the proper use of water supplies and the understanding of the distribution systems. An instructor's guide sheet provides this information: introduction to the topic, instructor preparation, length of unit, methods of instruction, testing, equipment and facilities required, recommended visual aids, and references. Following a list of unit objectives, a lesson plan outlines the main teaching points and states the preferred teaching method, cites the reference and page number(s) where the information is to be found, and indicates the necessary handouts. Other contents in the unit include a unit quiz, answer key to the quiz, and handouts (graphs, student worksheets, informational material, and forms). (YLB)

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FIRE SERVICE CERTIFICATION SERIES

UNIT FSCS-FF-9-80

WATER SUPPLY

FIRE SERVICE TRAINING

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WATER SUPPLY

Prepared by:

Paul F. Pribyl, Consultant
Fire Service Training

INTRODUCTION

Next to the air we breathe, water is most important to the existence of the human and animal life on our planet. This is particularly true in the fire service. Water is the most commonly used extinguishing agent. It then becomes quite apparent that we have to properly use the water to our advantage. The use of water starts the minute a suction sleeve is placed at a static source or a line is coonected to a hydrant. This unit will attempt to assist you in the proper useage of water supplies and the understanding of the distribution systems.

INSTRUCTOR PREPARATION

Carefully study the objectives to determine the goals that have been set for the fire fighters upon completion of this unit.

Review the lesson plans and if necessary, consult the references listed.

Develop suitable aduio-visual aids, provide training area and necessary tools and equipment to effectively teach this unit.

LENGTH OF UNIT

Classroom Work	3 hours 30 minutes
Evaluation and Testing	30 minutes

METHODS OF INSTRUCTION

Lecture-Illustration

Suggested methods and techniques are listed under Instructor's Notes on the lesson plans. For further information consult Fire Service Instructor Training, IFSTA #303, 3rd ed., pp. 71-83.

TESTING

At the end of this unit, a written quiz of five or more questions will be given in addition to the practical performance tests.

EQUIPMENT AND FACILITIES REQUIRED

Classroom with necessary audio-visual equipment
Indoor or outside area large enough to practice skills, having a fire hydrant and being relatively free of obstructions or traffic patterns
Hydrant wrench and necessary additional equipment
Tables and charts

REFERENCES

1. Hudiburg, E. Ed., Fire Stream Practices, #105, IFSTA, Stillwater, 5th Ed., 1972, pp. 25-29, 48, 60-61.

2. Hudiburg, E. and McCoy, C., Ed., Water Supplies for Fire Protection, #205, IFSTA, Stillwater, 2nd ed., 1971, PP 15, 23-26, 52.

3. Paige, J., Ed., Essentials of Fire Fighting, #200, IFSTA, Stillwater, 1st ed., 1977, pp. 335-341.

OBJECTIVES

All objectives in this unit are to be met according to the material contained in the International Fire Service Training Association Manuals # 105, Fire Stream Practices, #205 Water Supplies for Fire Protection and #200 Essentials of Fire Fighting.

To satisfactorily complete this unit, the firefighter must attain a grade of 70 or higher on the written quiz and successfully complete the practical skills examination.

NFPA STANDARD 1001

WATER SUPPLY

FIRE FIGHTER II

4-13 Water Supplies

4-13.1 The fire fighter shall demonstrate knowledge of the water distribution system and other water supplies in the local community.

4-13.2 The fire fighter shall identify the following parts of a water distribution system:

(1) Distributors
(2) Primary Feeders
(3) Secondary Feeders

4-13.3 The fire fighter shall identify the following types of fire hydrants:

(1) Dry-barrel Fire Hydrant
(2) Wet-barrel Fire Hydrant

4-13.4 The fire fighter shall identify the Following:

(1) Normal operating pressure of a water distribution system.
(2) Residual pressure of a water distribution system
(3) The flow pressure from an opening that is flowing water.

4-13.5 The fire fighter shall identify the following types of water main valves:

(1) Indicating
(2) Non-indicating
(3) Post Indicator
(4) Outside Stem and Yoke

OBJECTIVES

4-13 Water Supplies

4-13.6 The firefighter shall determine the fire hydrant usability by inspecting For:

(a) Obstruction to use of hydrant
(b) Direction of hydrant outlets to suitability of use
(c) Mechanical above-ground damage
(d) Condition of paint or rust and corrosion
(e) The full flow by opening and closing the hydrant
(f) Ability to drain

COURSE: FIRE SERVICE CERTIFICATION SERIES

LESSON: WATER SUPPLY

EQUIPMENT NEEDED: SLIDE, OVERHEAD PROJECTORS, SCREEN

TRAINING AIDS: SLIDES, TRANSPARENCIES, TEXTS

INSTRUCTORS NOTES	TEACHING POINTS
	A good water supply system should be of primary concern to a fire department. The importance of a water system was dramatically illustrated as early as 1906 when an earthquake in San Francisco severely damaged the water mains. The fire department consisted of 600 men with 62 engines and 15 ladder companies. Even with adequate manpower, the department was unable to handle the conflagration because of the lack of water. The importance of an adequate water supply system for fire fighting purposes was immediately apparent as a result of this tragedy.
Ref: Fire Stream Practices IFSTA #105 p. 9	I. Properties of Water
	A. Characteristics of water
	1. Freezing point 32 degrees F.
	2. Boiling Point 212 degrees F.
	3. Incompressible
	4. 62.5 lbs per cubic foot
	5. 8.33 lbs. per gallon
	6. 1 cubic foot = 7.48 gallons
p. 18	B. Advantages of water
	1. Greater heat absorbing capacity than other common agents.
	2. A relatively large amount of heat is required to change water into steam.
	3. The greater the surface area of water that is exposed, the more rapidly heat will be absorbed
	4. Water converted into steam occupies several times its original volume.
	5. Water is relatively inexpensive.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Fire Stream Practices IFSTA #105 p. 18	C. Disadvantages of Water 1. Considerable surface tension 2. Reacts with certain materials 3. Freezes at normal winter temperatures 4. Low viscosity 5. May be capable of conducting electricity
	II. Pressure affecting Water
Pp. 25-27	A. Principles of Pressure on Fluids 1. Fluid pressure is perpendicular to any surface on which it acts. 2. Fluid pressure at a point in a fluid at rest is of the same intensity in all directions. 3. Pressure applied to a confined fuid from witho is transmitted equally in all directions 4. The pressure of a liquid in an open vessel is proportional to its depth. 5. The pressure of a liquid in an open vessel is proportional to the density of the liquid 6. The pressure of a liquid on the bottom of a vessel is independent of the shape of the vessel.
pp. 27-29	B. Kinds of Pressure 1. STATIC PRESSURE IS STORED POTENTIAL ENERGY THAT IS AVAILABLE TO FORCE WATER THROUGH PIPE, FITTINGS, FIRE HOSE AND ADAPTORS.
4-13.4	2. NORMAL OPERATING PRESSURE IS THAT PRESSURE WHICH IS NORMALLY FOUND ON A WATER DISTRIBUTION SYSTEM DURING NORMAL CONSUMPTION DEMANDS. 3. RESIDUAL PRESSURE IS THAT PART OF THE TOTAL AVAILABLE PRESSURE THAT IS NOT USED TO OVERCOME FRICTION OR GRAVITY WHILE FORCING WATER THROUGH PIPE, FITTINGS, FIRE HOSE AND ADAPTORS.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Fire Stream Practices IFSTA #105, pp. 27-29	B. Kinds of Pressure 4. FLOW PRESSURE is forward velocity pressure at a discharge opening while water is flowing.
Ref Water Supplies for Fire Protection IFSTA #205 pp. 21-24 4-13.1	III. Sources of Water A. Hydrologic Cycle 1. Evaporation 2. Condensation 3. Precipitation B. River Supply C. Lake Supply D. Impounded Supply E. Ground Water Supply
Ref: Water Supplies for Fire Protection, IFSTA #205 pp.25-30 4-13.1	IV. Types of Distribution Systems A. Gravity System 1. A water source located at a higher elevation than the community or plant it is serving. 2. Water is collected in a suitable basin or reservoir. 3. Water is distributed by the natural pressure created by the differnces in elevation. Example: Every foot of elevation results in pressure of .434 psi, a reservoir located 250 feet above the community would provide a static pressure of approximately 108 psi. 4. Industry often erects steel gravity tanks to supply water for sprinkler systems in their plants. REMEMBER: Before utilizing this type of system be sure that the basin, reservoir or elevated tower will provide adequate amounts of water.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Water Supplies for Fire Protectin, IFSTA #205 pp. 25-30

4-13.1

IV. Types of Distribution Systems

B. Direct Pumping System

1. Water is pumped directly from the source into the distribution system with little or no elevated storage.

2. Normally passes through filteration plant before entering distribution system.

3. More efficient, modern direct pumping systems may be computer controlled and employ:

a. variable speed pumps

b. pressure regulating devices

c. auxilliary power supply

all of which are completely automated.

C. Combination System

1. Combination of gravity and direct pumping systems

2. Take water from supply source and discharge either directly into the distribution system or through the filteration plant and then into the system.

3. Equipped with standpipes, elevated tanks or reservoirs which are located at strategic points and act as reserve storage containers for the system. Generally located:

a. at ends of long feeder lines

b. at extreme boundaries of the distribution system

c. or near the center of an area which has exceptional peak demands

4. With this type of system, water can be pumped into the system at a reasonable, uniform rate.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Water Supplies for Fire Protection, IFSTA #205 pp. 25-30	IV. Types of Distribution Systems
	C. Combination System
4-13.1	a. if the demand is less than the rate at which the water is being pumped it will flow into the storage facilities
	b. if the demand is greater than the amount supplied from the pumping station, water flows back into the system from the storage tanks or reservoirs.
	V. Elevated Storage Reservoirs
	A. Usually of steel, may be reinforced concrete
	B. Capacity up to 2,000,000 gallons
Ref; Fire Stream Practices IFSTA #105 p. 61	C. Determining Tank Capacity
	The capacity of a circular tank 10 feet in diameter and 15 feet long may be accurately calculated mathematically.
	Cubic feet = PIr squared x length
	Pi = 3.1416
	3.1416 x 25 x 15
	78.54 x 15 = 1,178 cubic feet
	1 cu, ft. = 7.48 gallons
	7.48 x 1,178 = 8,811 gallons
	For large bulk tanks or storage reservoirs use the formula
	Gallons = diameter squared x 6 x length
	100 x 6 x 15
	600 x 15
	9,000 gallons

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Water Supplies for Fire Protection, IFSTA #205, pp. 31-60

p. 31-32

VI. Water Mains and Valves

A. Type and Installation

Water mains and fittings for fire protection should be suitable for working pressures and conditions of the particular water supply system on which they are installed.

1. Ordinarily, water main pipes are constructed of:

a. cast iron
b. ductile iron
c. asbestos cement
d. plastic

Special conditions however, may require other types of pipe. For example:

a. water mains installed in unstable or corrosive soils
b. difficult access areas
c. mains under railroad tracks and highways
d. close to heavy industrial machinery
e. earthquake areas
f. through rugged terrain

In these cases, steel or reinforced concrete pipes are used.

P. 32

B. Distribution System

The distribution system of a water utility is that part which:

a. receives the water from the pumping station

and

b. delivers it through the area to be served.

The following items are supplementary parts of the distribution system:

a. fire hydrants
b. gate valves
c. elevated storage
d. reservoirs
e. standpipes

INSTRUCTORS NOTES

TEACHING POINTS

Ref. Water Supplies for Fire Protection, IFSTA #205 pp. 31-60

P. 32

4-13.2

VI. Water Mains and Valves

B. Distribution System

The term "GRID" is sometimes used to describe a network of water mains that make up a distribution system.

A "GRID" system should consist of the following:

PRIMARY FEEDERS consisting of large pipes with relatively wide spacing which convey large quantities of water to various points of the system for local distribution to the smaller mains.

SECONDARY FEEDERS forming the network of pipes of intermediate size which reinforce the grid within the various loops of the primary feeder system and aid the concentration of the required fire flow at any point.

DISTRIBUTORS consisting of a grid arrangment of smaller mains serving the individual fire hydrants and blocks of consumers.

P. 33

In the past 4-inch and 6-inch pipe was used for grid purposes.

Good fire protection practices suggest the following as minimum size for pipe:

RESIDENTIAL DISTRICTS

8-inch mains - 6-inch to be used only where it will complete a good grid and is cross-connected at inetrvals not exceeding 600 feet.

SHOPPING CENTERS-INDUSTRIAL AREAS

12-inch mains to be used for long lines not interconnected.

8-inch to be used only in sections where it will complete a good grid.

Larger size mains may be needed depending upon size, layout and occupancy of structures.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Water Supplies for Fire Protection, IFSTA #205, pp. 31-60	VI. Water Mains and Valves
p. 33	B. Distribution System
	MULTIPLE HOUSING DEVELOPMENTS
	At least 8-inch mains, but in many instances paralleling the requirements for industrial districts.
4-13.5	C. Water Main Valves
p. 40-44	The function of a valve in a water distribution system is to provide a means for controlling the flow of water through the distribution piping.
	Valves should be:
	Operated at least once a year
	Spaced no more than 500 feet apart in high value districts and 800 feet apart in other areas.
	Valves are broadly divided into:
	INDICATING TYPE
	A valve which visually shows the position of the gate or valve seat (closed, partially closed or open)
	Valves in private fire protection are usually of the indicating type.
	NONINDICATING TYPE
	Except for possibly a few valves in treatment plants and pumping stations, valves in public water systems are of the nonindicating type.
	Valves in a water system normally are buried or installed in manholes.
	A valve box will be provided and the valve is operated by a special socket wrench on the end of a reach rod known as the valve key.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Water Supplies for the Fire Service IFSTA #205 pp. 31-60

p. 42

14-3.5

VI. Water Mains and Valves

C. Water Main Valves

Control valves in water distribution systems may be either:

GATE VALVES usually of the non-rising stem type and as the valve nut is turned by the valve key (wrench) the gate either raises or lowers to control the water flow.

BUTTERFLY VALVES usually have rubber or rubber composition seat which is bonded to the valve body. The valve disk rotates 90 degrees from the fully open to the tightly shut position.

Both valves can be of the indicating type if desired but this is not normally the case.

OUTSIDE STEM AND YOKE (OS&Y) is a common indicating valve for private fire protection systems. The extended threaded stem indicates an OPEN valve thread not showing, CLOSED VALVE.

POST INDICATOR VALVE (PIV) is connected to an underground gate valve and shows the valve's position through a window. The lever arm should be locked to prevent tampering. Also PIV should be marked to indicate section of system it controls.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: Water Supplies for the Fire Service, IFSTA, #205, pp. 31-60

4-13.3

p. 47

VII. Fire Hydrants

A. Types of Hydrants

The two main types of modern fire hydrants are the dry-barrel and wet-barrel.

DRY-BARREL HYDRANT is usually classified as a compression or knuckle-joint type which may open with or against the pressure.

Any water remaining in the dry-barrel hydrant will drain through a small valve in the bottom which opens as the main valve approaches the closed position.

WET-BARREL HYDRANT usually have a compression type valve at each outlet or they may have only one valve that is located in the bonnet which controls the flow of water to all outlets.

In general, hydrant bonnets, barrels and foot pieces are made of cast iron. The important working parts are usually made of bronze, but valve facings made be made of rubber, leather or a composition material.

B. Fire Hydrant Specifications

The American Waterworks Association
6666 West Quincy Avenue
Denver Colorado, 80235

has adopted specifications for a national standard hydrant for ordinary waterworks service.

These specifications are designed to produce a hydrant that is free from difficulties such as:

Trouble in opening and closing
Working loose of interior parts
Leakage, Excessive friction loss
Failure to drain properly
Loose nipples

INSTRUCTORS NOTES

Ref; Water Supplies for the Fire Service, IFSTA, #205 pp. 31-60

TEACHING POINTS

VII Fire Hydrants

C. Marking

Green - 1000 or more gallons per minute flow

Orange - 500 to 1,000 gallons per minute flow

Red - 500 gallons per minute or less flow

D. Installation

The hydrant should be installed:

Perpendicular to the ground with the lowest discharge outlet 15 inches above grade.

So that if provided with a pumper connection there is sufficient clearance beween the connection and the ground in order to operate the hydrant wrench and the long lugs on the intake hose.

With the large outlet facing the road and pumper.

Insuring that the distance from curb to outlet is less than that of inlet hose to be used at hydrants.

The hydrant should not be installed:

Close to:

Trees
Mailboxes
Posts
Signs
Fences

or other obstructions that may cause fire department operations to be impaired.

E. Distribution

The process of locating and spacing fire hydrants should be the responsibility of the fire department.

There are occasions when the fire and water departments must work together to make definite plans and the fire department should be able to give good reasons for any recommendation.

INSTRUCTORS NOTES

TEACHING POINTS

Ref; Water Supplies for the Fire Service, IFSTA, #205, pp. 31-60

VII. Fire Hydrants

E. Distribution

Adequacy is not just a question of the total supply of water which must be delivered to a district. Consideration must also be given to determine whether ther are enough hydrants to provide water without excessively long hose lines.

Fire hydrants should be spaced and located with consideration of their possible use as may be refelected by the hazards of the locality.

Fire hose lines over 400 feet long are susceptible to excessive friction loss and inadequate flow.

The nearest fir hydrants, therefore, should not be located more than 300 feet away from all sides of the building to be protected.

IN HIGH VALUE OR LIFE HAZARD DISTRICTS

One or two hydrants should be located at each street intersection with intermediate hydrants between intersections so located that spacing does not exceed 300 feet.

IN RESIDENTIAL DISTRICTS

One hydrant should be located at each street intersection with intermediate hydrants bewteen intersection so located that spacing does not exceed 500 feet.

They should be located adjacent to paved roadways suitable for fire apparatus and, where possible spaced at least 50 feet from any building.

F. Hydrant Outlets

Regardless of the design or type of a public fire hydrant, the outlets are considered to be standard if there is a minimum of one large large outlet (4 or 4 1/2-inch) for pumper supply and one outlet for 2 1/2-inch hose.

Hydrant specifications require a 5-inch vavle opening for standard 3-way hydrants and a 6-inch connection to the water main.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Water Supplies for the Fire Service IFSTA, #205, pp. 31-60	VII. Fire Hydrants
	F. Hydrant Outlets
p. 51	The threads on all hydrant outlets must conform to those used by the local fire department. National Standard hose coupling screw threads are most desirable from the standpoint of mutual aid and interdepartmental operations. Refer to: NFPA Standard No. 194 Screw Threads and Gaskets For Fire Hose Connections REMEMBER: One 4 1/2-inch hydrant outlet will deliver over three times the water one 2 1/2-inch outlet will deliver. Even when two 2 1/2-inch outlets are connected to a pumper intake, the flow is considerably less than from a 4 1/2-inch outlet.
p. 52 4-13.6	G. Hydrant Maintenance Fire hydrants should be inspected at least twice a year, preferably in the spring and fall as well as after each use. A person who is selected to inspect fire hydrants should be properly trained in construction and design features and should understand how fire hydrants operate. Any regular member of a fire department my qualify if trained in the proper procedure. In order to make a complete inspection of the hydrants, an inspector should be equipped with: 1. A loose leaf notebook 2. A gauging device for checking threads 3. A can of lubricating oil 4. A container of light lubrication oil and graphite 5. A small flat brush 6. Gate valve key and hydrant wrench 7. Pressure gauge w/tapped hydrant cap 8. Hand pump for pressure up to 200 psi 9. 12-quart pail and gaskets

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Water Supplies for the Fire Service, IFSTA, #205, pp. 31-60 P. 53 4-13.6	VII. Fire Hydrants. G. Hydrant Maintenance <u>Inspection</u> Check for any obstructions to hydrant operation Check to see that hydrant faces the proper direction Check for sufficient clearance between bottom of butt and ground (Should be at least 15-inches) Check to see if the hydrant has been damaged by traffic or is set to close to the road or in a location where it can be damaged by traffic. Check to insure that hydrant is not obscured by weeds or bushes on snow piles in the winter months. Check for indications of rusting or corrosion Open caps and inspect hydrant barrels and butts for foreign objects Look to see if a dry-barrel hydrant contains water when cap in removed which would indicate drain valve is inoperative or valve is leaking Open hydrant carefully and completely Flow until water is clear After flushing, close the hydrant slowly to prevent "water Hammer" in the main. Attach tapped cap and gauge to an outlet of the hydrant, tighten other caps, turn on water and read and record static pressure. Close hydrant and observe if it drains properly. Swab the threads of hydrant caps with a mixture of oil and graphite. Wipe threads clean with a rag, replace gaskets if necessary and replace caps on hydrant. Clean and lubricate threads on hydrant outlets Oil hydrant valve control stem

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Water Supplies for the Fire Service, IFSTA, #205, pp. 31-60 p. 55 4-13.6	VII. Fire Hydrants. G. Hydrant Maintenance Inspection Free chains of excess paint and insure they run freely around caps Insure hydrant protection devices do not interfere with the fire departments ability to reach and operate from the hydrants.

UNIT QUIZ

1. The freezing point of water is:

   a. 32 degrees F.

   b. 17 degrees C.

   c. 212 degrees F.

   d. 32 degrees C.

   (Circle letter at the correct answer)

2. List two advantages of water:

   _____

   _____

3. Water weighs _____pounds per cubic foot.

   a. 63.0

   b. 57.3

   c. 62.5

   d. 60.5

   (Circle letter at the correct answer)

4. Fluid pressure is _____to any surface on which it acts

   a. at rest

   b. perpendicular

   c. proportional

   d. equal

   (Circle letter at the correct answer)

5. Part of the total available pressure that is not used to overcome friction or gravity while forcing water through pipe, fittings, fire hose and adaptors is:

   a. flow pressure

   b. static pressure

   c. residual pressure

   d. normal pressure

6. List three (3) sources of water supply:

_____

_____

_____

7. List two types of fire hydrants:

_____

_____

8. The pressure of a liquid on the bottom of a vessel is _____ of the shape of the vessel.

   a. proportional

   b. parallel

   c. equal

   d. independent

   (Circle the letter at the correct answer)

9. Forward velocity pressure at a discharge opening when flowing water is:

   a. Normal operating pressure

   b. Flow pressure

   c. Static pressure

   d. Residual pressure

   (Circle the letter at the correct answer)

10. Pressure applied to a confined fluid from without is transmitted _____ in all directions

    a. independently

    b. equally

    c. alternately

    d. quickly

    (Circle the letter at the correct answer)

11. One gallon of water weighs:

    a. 8.33 pounds

    b. 9.35 pounds

    c. 7.33 pounds

    d. 6.30 pounds

    (Circle the letter at the correct answer)

12. List two disadvantages of water:

_____

_____

13. Find the correct gallonage for a cylindrical tank 10 feet in diameter and 15 feet long using the formula

    pi x r^2 x length pi= 3.1416

Place your answer here _____

14. Fluid pressure at a point in a fluid at rest is of the same_____ in all directions:

    a. independence

    b. height

    c. proportion

    d. intensity

    (Circle the letter at the correct answer)

15. One cubic foot of water equals _____ gallons

    a. 6.44

    b. 8.33

    c. 7.48

    d. 3.14

    (cirle letter at the correct answer)

16. Pressure which is normally found on a water distribution system during normal consumption demands is:

    a. flow pressure

    b. residual pressure

    c. normal operating pressure

    d. static pressure

    (Circle letter at the correct answer)

17. Stored potential energy that is available to force water through pipe, fittings, fire hose and adaptors, is:

    a. flow pressure

    b. residual pressure

    c. normal operating pressure

    d. static pressure

    (Circle the letter at the correct answer)

18. Draw the component parts of a simple water supply system, including storage

19. Why must a hydrant be fully opened

    a. To gain the proper pressure

    b. To get water on the fire

    c. To insure proper operation and closing of drains

    d. To allow the water department to monitor the flow

    (Circle the letter at the correct answer)

20. In color coding hydrant bonnets to indicate flow capability

    Red indicates a flow of _____ gpm

    Green indicates a flow of _____ gpm

    Orange indicates a flow of _____gpm

ANSWER KEY

1. 32 degrees F.

2. Greater heat absorbing capacity than other common agents

   A relatively large amount of heat is required to change water into steam

   The greater the surface area of water that is exposed the more rapidly the heat will be absorbed

   Water converted into steam occupies several times its original volume

   Water is relatively inexpensive

3. c. 62.5 pounds

4. b. perpendicular

5. b. static

6. River supply

   Lake supply

   Impounded supply

   Ground water supply

7. Dry-barrel
   Wet-barrel

8. d. independent

9. b. flow pressure

10. b. equally

11. a. 8.33 pounds

12. Considerable surface tension

    reacts with certain materials

    Freezes at normal winter temperatures

    Low viscosity

    May be capable of conducting electricit

13. 8,811 gallons

14. d. intensity

15. c. 7.48 gallons

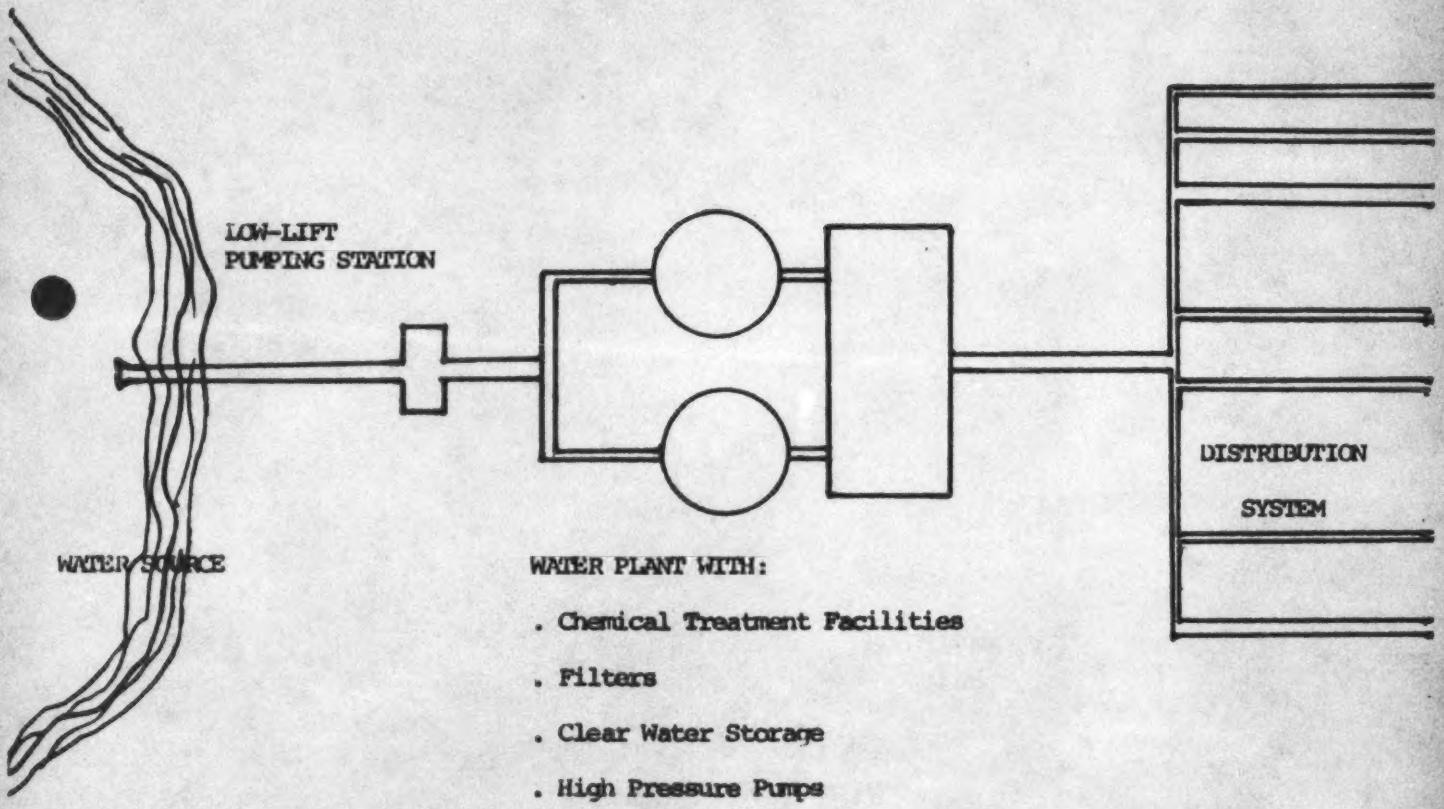
16. c. normal operating pressure

17. d. static pressure

18. Processing or treatment plant
    Mechanical or other means of moving water
    Distribution center including storage

19. c. To insure proper operation and closing of drains

20. Red 500 gpm or less
    Green 1,000 or more gpm
    Orange 500 to 1,000 gpm



WATER PLANT WITH:

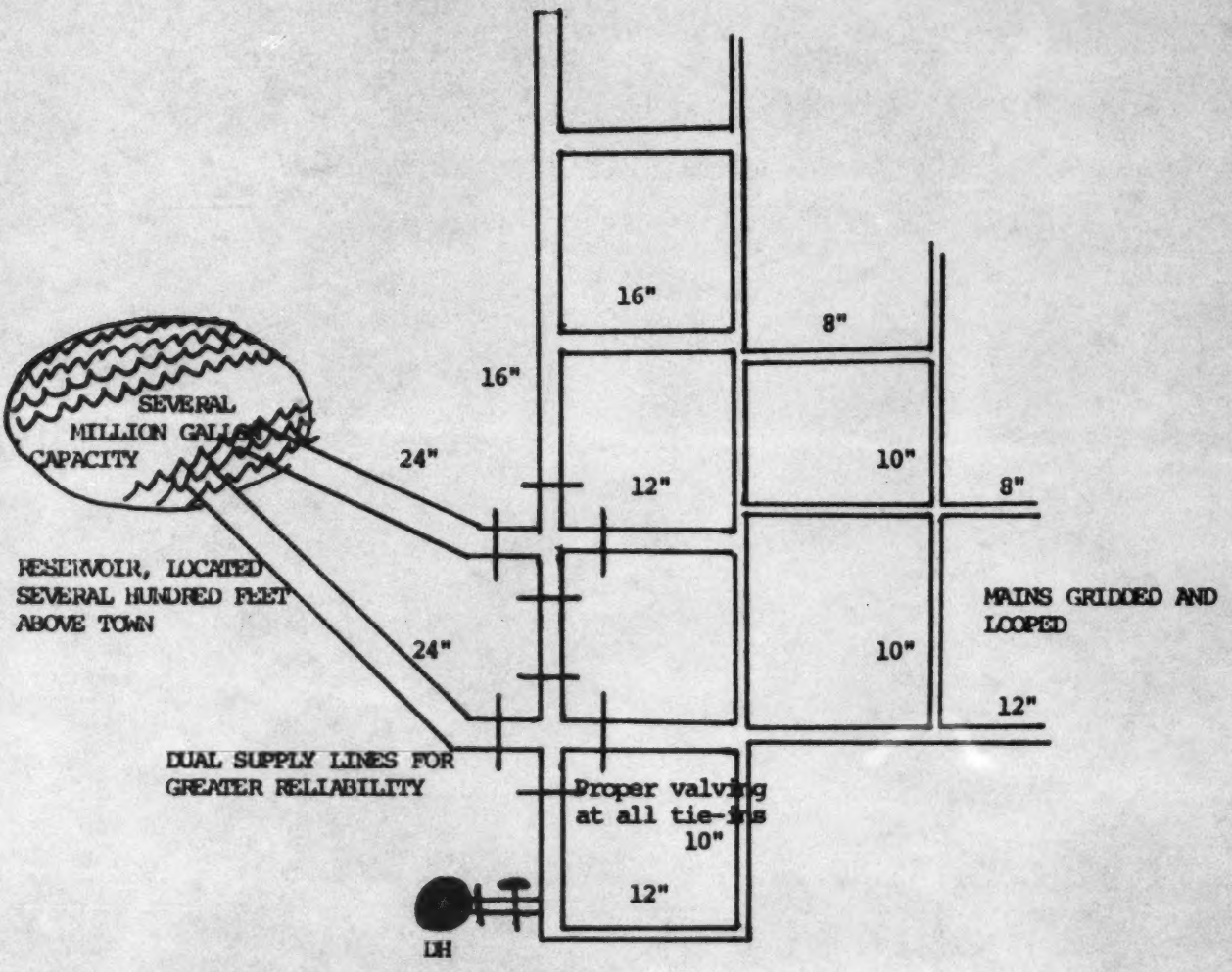
. Chemical Treatment Facilities

. Filters

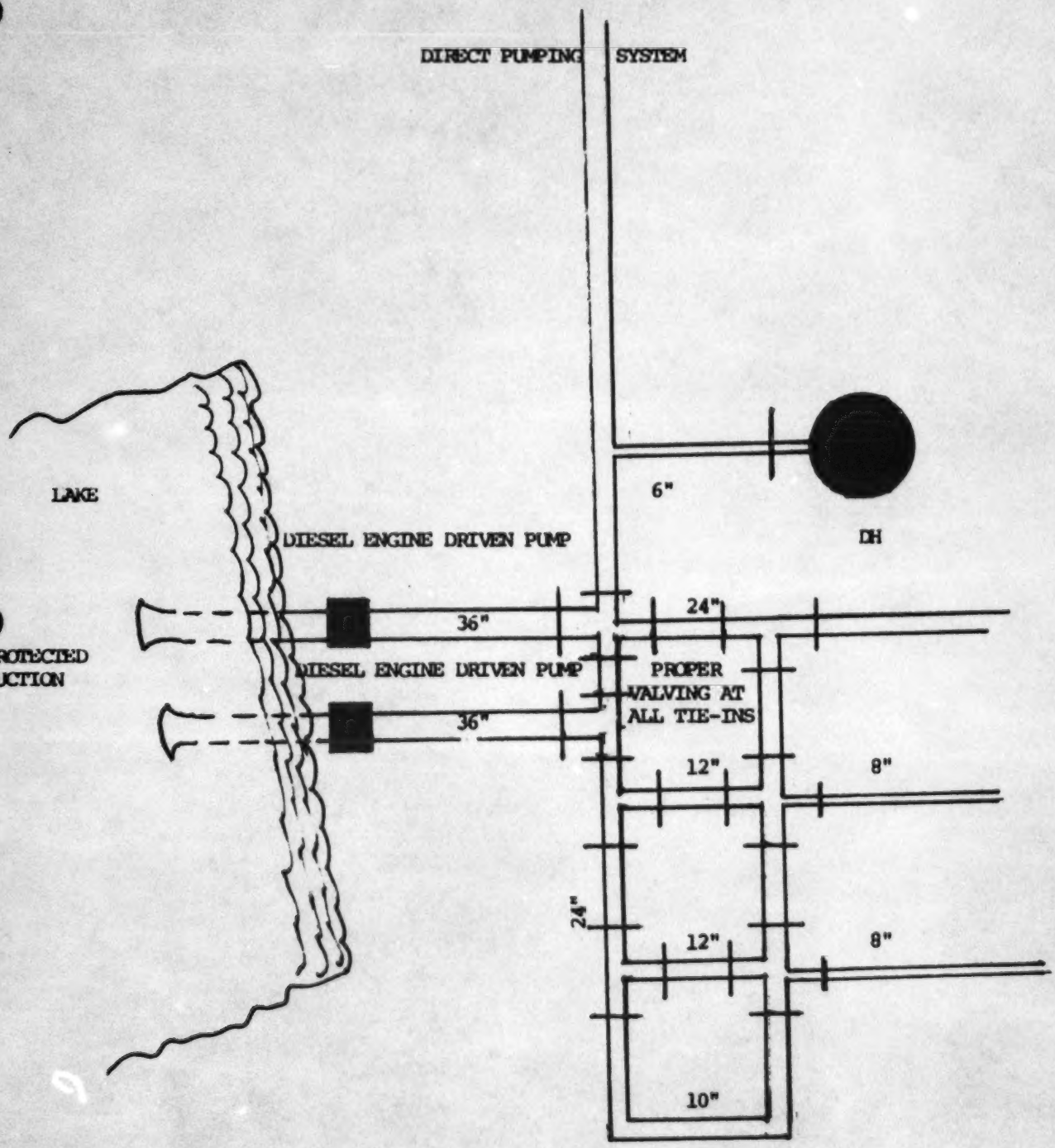
. Clear Water Storage

. High Pressure Pumps

GRAVITY SYSTEM



Hydrant with individual
key operated valve


DIRECT PUMPING SYSTEM
LAKE
6"
DH
DIESEL ENGINE DRIVEN PUMP
24"
36"
PROTECTED SUCTION
DIESEL ENGINE DRIVEN PUMP
PROPER VALVING AT ALL TIE-INS
36"
12"
8"
24"
12"
8"
10"

COMBINATION SYSTEM